EXHIBIT D

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:	)		
	)		
RODNEY M. LAFOLLETTE, ET AL.	)	Docket:	7310
	)		
Serial No.: 09/037,801	)	Art Unit:	1745
	)		
Filed: March 10, 1998	)	Examiner:	MARIA NUZZOLILLO
	)		
For: MICROSCOPIC BATTERIES FOR MEMS SYSTEMS	)		
	)		

DECLARATION OF RODNEY M. LAFOLLETTE, PH.D.

Honorable Commissioner of Patents and Trademarks
Washington, D.C. 20231

Sir:

I, Rodney M. LaFollette, state as follows:

1. I am a citizen of the United States of America and a resident of the State of Utah.

2. I have earned a Doctorate in Chemical Engineering from the Brigham Young University.

3. My educational and professional resume is attached as Exhibit "A."

4. I have over 12 years of business and educational experience. This experience includes extensive experience in the electric battery field.

5. I am an inventor, either sole or joint, of inventions comprising the subject matter of U.S. patent applications and issued patents. I am a co-inventor of the invention of the above-identified patent application.

6. I have worked extensively in research and development pertaining to electric batteries and am thoroughly familiar with various electric battery and fuel cell developments.

7. I have been requested to provide an assessment of the claimed subject matter of the above-identified application in comparison with certain prior art patents and to provide information concerning the clarity of certain language within the presently pending claims.

8. I consider my skill in the electric battery field to be above ordinary skill.

9. In the course of functioning as indicated above, I received a copy of the above-identified application, as filed.

10. I received also a copy of the Office Action in the above-identified application mailed February 23, 2000, a copy of the two patents relied upon by the Examiner in said Office Action, and a copy of the Amendment being filed just before this Declaration.

11. I was asked to evaluate the 35 USC § 112, second paragraph and the 35 USC § 103(a) rejections contained within the Office Action.

12. I am familiar with the invention of the above-mentioned application, as originally filed, and the claims as originally filed and as presently constituted, due to the above-mentioned Amendment, because I have studied both. I have also read and studied the patents relied upon in the said Office Action.

13. Elected claims 10-43, 51-54, 89-92 and 94-97, as originally constituted, were rejected under 35 USC § 103(a) over Hockaday 5,759,712 (Hockaday '712) in view of Hockaday 5,631,099.

14. The problem confronting '712 was not concerning batteries, but rather fuel cells.

15. Hockaday '712 was not concerned with microscopic fuel cells not integrated with microelectromechanical systems (MEMS) or other microscopic circuits.

16. In addressing his problem, Hockaday '712 states:

> It is desirable to use fuel cells for small appliances. H-Power Corporation is working with Analytic Power Corporation to produce a 25 watt power fuel cell to

drive video recorders. Pressurized metal hydride hydrogen cylinders or decomposing hydrides were expected to be used as fuel supply.

* * * *

New parameters are opened up for fuel cells with the advent of new binary catalysts such as Pt/Ru for direct electrocatalysis of methanol at room temperatures. Directly fueled fuel cells that run high energy density socially acceptable fuels are possible. If fuel cells can run at room temperature and pressures, then there is no thermal or complexity scale factor that constrains the dimensions or power sizes of the fuel cells. The next step in the evolution is to reduce the catalyst costs and simplify the fuel cell assembly to be cost effective.

Hockaday '712 page 1, Col. 1, lines 65-70 and Col. 2, lines 17-27. Hockaday '712's field of concern was macroscopic, not microscopic.

17. Hockaday '712 recognizes that fuel cells and batteries are different in fundamental ways, when he proposes that his macroscopic fuel cell be combined with a conventional "electrical storage device such as a rechargeable battery." Col. 2, lines 32-33. While Hockaday's macro fuel cell may be miniaturized, it is far from microscopic and is not integratable with MEMS or the like.

18. Hockaday '712's specific contribution is:

The subject of the present application is to add on the advances that have occurred in the Replica Fuel Cell since the last application and to describe many of the novel applications of the Replica Fuel Cell. A critical new advance is the further development of a cost effective pore-free electrode that is only permeable to hydrogen as an ion. That in turn increases the efficiency and practicality of direct alcohol fuel cells because it blocks the poisoning alcohol diffusion through the electrolyte. Making small alcohol powered fuel cells practical.

19. Hockaday '712 concedes that fuel cells require that reactants be externally supplied to react in the presence of an electrolyte, electrodes and a catalyst.

20. The basic problem addressed in the above-identified application is stated at page 2, lines 10-17:

Heretofore, MEMS technology has typically focused on the need to fabricate MEMS and electronic devices that meet these three goals, but has failed to address the difficult problem of electrical energy availability and management. The overall goals of many MEMS applications has not and will not be met unless one or more appropriate MEMS power sources are developed.

* * * *

Conventional wisdom has required and still requires that electrical power be supplied from relatively large, heavy external sources.

21. The intended solution fashion to Applicant's problem is stated at page 8, lines 16-21:

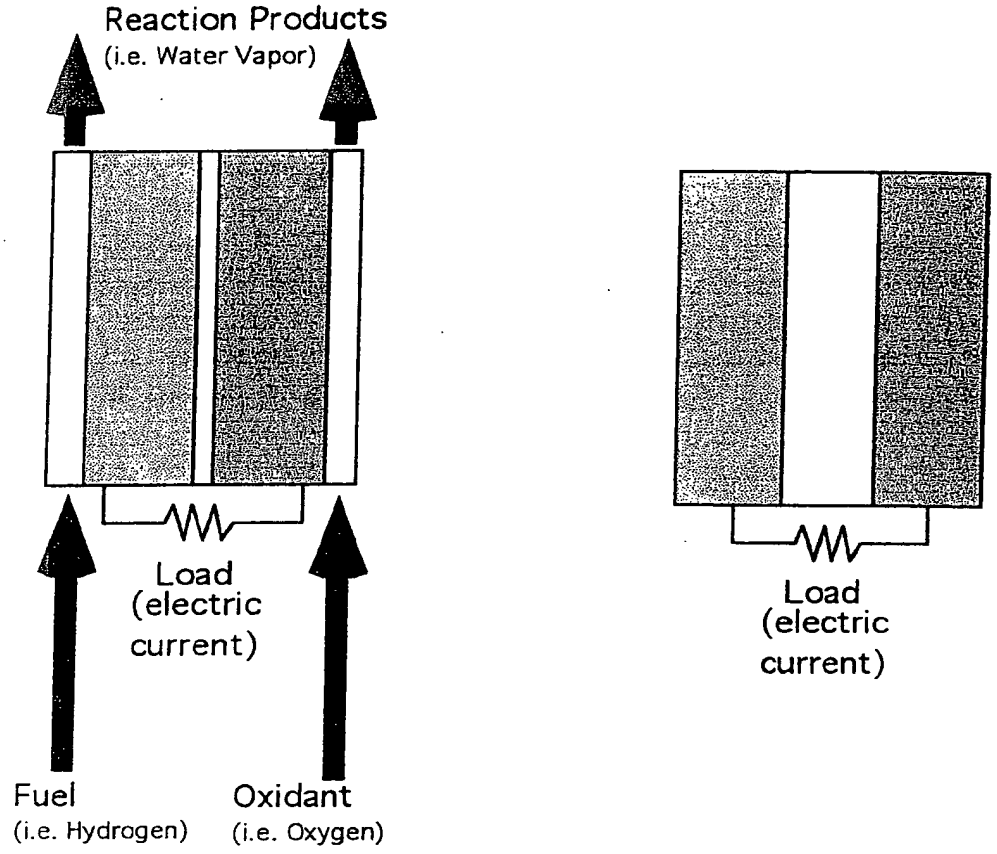
> The major obstacle in using batteries in MEMS is the size and weight of available batteries. To date, large external batteries have been used. Internal batteries must be microscopic, not macro-scopic. Dimensions must be in micrometers, rather than centimeters, and good specific power and specific energy must be available. Presently, the smallest external batteries available commercially are of the order of 0.1 to 1 cm^3 in volume and 1 to 3 g in weight.

22. The Applicants were able to succeed in providing the intended solution. The Hockaday references, alone or together, do not solve Applicants' problem.

23. Hockaday '712 provides teachings directed to construction of fuel cells, some of which are combined with a conventional macro battery. Hockaday '712 teaches nothing about microscopic batteries or integration of microscopic batteries with MEMS.

24. There are major differences between fuel cells and batteries. The Applicants disclose and claim microscopic *batteries*, not fuel cells. Fuel cells and batteries are both electrochemical devices, to be sure. Both produce electricity from reaction of chemicals, and contain electrodes and electrolytes. However, they are in most other respects distinct in both operation and function. Fuel cells require a continuous externally-provided supply of both fuel and oxidant (such as air) for operation. Fuel cells are not considered *energy storage* devices. Rechargeable batteries are energy storage devices. They normally hold a fixed internal quantity of both "fuel" and"oxidant." For

example, a lead acid battery contains the "fuel" (lead metal), the "oxidant" (lead dioxide). The amount of energy the battery can store is dependent on the amounts of the reactants (lead and lead dioxide) that are *stored* internally within the battery. The differences between a fuel cell which is an "open system" and a battery which is a "closed system" are depicted in the Figure below:



Fuel Cel l

Externally-Supplied Reactants

Batter y

Internally-Stored Reactant

25. Not only do fuel cells require that fuel and/or oxidant be supplied from an external source, they typically require an external support structure, including fuel delivery, fuel conditioning, and/or oxidant conditioning. Batteries do not require such support. In this respect, batteries are simpler to build and operate than fuel cells. On the other hand, batteries are harder to build than fuel cells, due to their need to store their reactants internally. As such electrode construction is different

and often more difficult. Reaction products must be accommodated. For example, many batteries produce gas (oxygen and/or hydrogen) as a side reaction. The disposition of these gases is more difficult than with fuel cells. Chemical reactions that occur within batteries usually involve changes in volume, which must be accommodated in battery construction. These and other issues sometimes make battery construction more difficult than that of fuel cells.

26. Fuel cells do not enable electronic devices in the same way that batteries do. Batteries allow independence from outside sources, at least temporarily; fuel cells do not. Batteries allow for an electronic device to be completely self-contained; fuel cells do not.

27. Hockaday '712 describes use of fuel cells in conjunction with a rechargeable battery. The battery described is a macroscopic battery, orders of magnitude larger than the batteries Applicants describe and claim. The batteries are *not* integrated, as they are physically attached to the device that will use them. In essence, Hockaday '712 discloses use of his fuel cells to charge an existing (even commercially available) large battery. The Applicants describe and claim microscopic batteries, which are integrable with the rest of the device.

28. Battery electrodes and fuel cell electrodes are very, very different in construction and purpose. For example, the thin-film nature of the fuel cell electrodes would not be very useful for batteries, due to the need to store reactants. There are many other issues as well, that make the approach presented by Hockaday '712 wholly unsuited for building electrodes for batteries.

29. The electrolyte cavity mentioned is also different between batteries and fuel cells. In a fuel cell, the electrolyte itself is not consumed in the fuel cell reaction. For example, in a hydrogen/oxygen fuel cell, water is often produced at one electrode and consumed at the other, so that there is no net consumption. In a battery, this is very often not the same. The electrolyte cavity must contain sufficient electrolyte to allow operation of the battery until the electrode reactants are

consumed. Furthermore, the electrolyte cavity in a battery will often need to allow transport of gaseous species, which is not required in a fuel cell. An example is a nickel-zinc battery, where oxygen and hydrogen are evolved at opposing electrodes during battery charging. The hydrogen gas passes through the electrolyte cavity to the other electrode, where it is chemically recombined with oxygen gas, to form water (which was originally consumed during gas evolution). In a fuel cell, gas crossover is not tolerated, and efforts are made to minimize gas transport through the electrolyte cavity.

30. The Hockaday '712 fuel cells are incapable of functioning as microscopic batteries or to be integrated with a MEMS or the like. Fuel cells are not energy storage devices. They are not internally sufficient, but require external provision of reactants.

31. In my opinion, the express limitations of each of the presently pending claims are not fully met by nor made obvious to one of ordinary skill in the art from either or both of the two Hockaday references.

32. The Examiner rejected all of the elected claims, as originally submitted, as ambiguous under 35 USC § 221, second paragraph.

33. My understanding of controlling § 112 case law is set forth below:

(a) 35 USC § 112, second paragraph, reads as follows:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

(b) I am advised, under this statute, the inventor must focus, in his claims, on that which constitutes his inventive contribution. If his or her invention is broad, it may be claimed in broad terms. Extraneous information, not strictly part of the invention, does not have to be recited in the claims.

(c) I am further advised that the issue presented by the Examiner in regard to § 112, second paragraph, pertains to what is sufficiently particular so as to distinctly claim the subject matter the Applicant considers to be his invention. Extensive detail is not required and broad recitations which have a substantial scope are not necessarily vague just because such limitations would encompass more than one way of accomplishing something or a plurality of structures for accomplishing something.

(d) The basic § 112, second paragraph case law standard is set forth in Antonious v. ProGroup, Inc., 217 USPQ 875, 877 (6th Cir. 1983), which is:

> The standard of definiteness is one of reasonableness under the circumstances. Charvat v. Commissioner of Patents, 503 F.2d 138, 147-51, 182 USPQ 577, 584-88 (D.C. Cir. 1974); Georgia-Pacific Corp. v. United States Plywood Corp., 258 F.2d 124, 136, 118 USPQ 122, 131-32 (2d Cir. 1958). The teachings of the prior art and the nature of the particular invention are to be considered in determining whether the claims meet the statutory requirement of definiteness and particularity. In re Moore, 439 F.2d, 1232, 1235, 169 USPQ 236, 238-29 (CCPA 1971).

(e) Reliance upon the knowledge of terms by those skilled in the art does not violate § 112. See State Industries, Inc. v. A.O. Smith Corporation, 221 USPQ 958, 975 (Tenn. Dt. Ct. 1983), which holds:

> Every patent application relies to some extent on the reader's knowledge of the terms, concepts and constructions it embodies and, therefore, relies to some extent upon knowledge of persons skilled in the art to complement that disclosed in order that it be enabling within the meaning of 35 USC § 112. In re Lange, supra; In re Wiggins, 488 F.2d 538, 543, 179 USPQ 421, 424-25 (CCPA 1973); Rengo Co. Ltd. v. Molins Machine Co., Inc., 211 USPQ 303 (3d Cir. 1981).

(f) There is no fundamental ambiguity based upon the aforesaid reasonableness standard in the claims as originally submitted, nor as presently constituted. The standard for definiteness is not only one of reasonableness under the circumstances but must take into account

the teachings of the prior art and the nature of the invention at hand. See Radio Steel & Mfg. Co. v. MTD Products, Inc., 220 USPQ 35, 41 (Ohio Dt. Ct. 1983), which states:

> The standard of definiteness is one of reasonableness under the circumstances, and the teachings of the prior art and the nature of the particular invention are to be considered in determining whether the claims meet the statutory requirement of definiteness and particularity. Antonious v. ProGroup, Inc., 699 F.2d 337, 217 USPQ 875 (6th Cir. 1983). (Emphasis provided.)

(g) The Federal Circuit has rejected the notion that literal support in the specification for terms which are clear is required under § 112. See In re Kaslow, 217 USPQ 1089, 1096 (CAFC 1983) which states:

> The test for determining compliance with the written description requirement is whether the disclosure of the application as originally filed reasonably conveys to the artisan that the inventor had possession at that time of the later claimed subject matter, rather than the presence or absence of literal support in the specification for the claimed language. In re Edwards, 558 F.2d 1349, 196 USPQ 465 (CCPA 1978); In re Herschler, 591 F.2d 693, 200 USPQ 711 (CCPA 1979) (Emphasis supplied.)

(h) The aforesaid standard, as to claims, was repeated by the Board in Ex parte Kristensen, 10 USPQ 2d 1701, 1703 (Bd. Of Pat. Appeals and Interf. 1989), which states:

> In Moore, the court held that with respect to the second paragraph of Section 112, the inquiry is "to determine whether the claims do, in fact, set out and circumscribe a particular area with a reasonable degree of precision and particularity." (Emphasis added.)

(i) The Board points out in Ex parte Adrianus P.M.M. Moelands, 3 USPQ 2d 1474, 1476 (Bd. of Pat. Appeals and Interf. 1987) that:

> We will also not sustain the rejection of claims 9, 11 and 20 under 35 U.S.C. 112, second paragraph. This statutory provision merely requires that the claims set forth and circumscribe a particular area with a reasonable degree of precision and particularity. The definiteness of the claim language employed must not be analyzed in a vacuum, but always in light of the teachings of the prior art and of the particular application disclosure as it would be interpreted by one having ordinary skill in the pertinent art. In re Moore, 58 CCPA 1042, 439 F.2d 1232, 169 USPQ 236 (1971). (Emphasis supplied.)

(j) Similarly, the same standard is set forth in MPEP Section 706.03(d) which reads:

> . . . [the Examiner] should allow claims which define the patentable novelty with a reasonable degree of particularity and distinctness. Some latitude in the manner of expression and the aptness of terms should be permitted even though the claim language is not as precise as the examiner might desire. (Emphasis provided.)

The claims as well as the specification are reasonable precise and particular, in my opinion.

(k) As stated in Railroad Cynamics, Inc. v. A. Stucki Co., 218 USPQ 618, 631 (E.D. Pa. 1983):

> Finally, the fact that a claim "may be broader than the specific embodiment disclosed in a specification is in itself of no moment." [In re Rasmussen,] 650 F.2d at 1215 [211 USPQ 323 (CCPA 1981)]. The claims not the drawings, define the scope of the patent, and every conceivable embodiment need not be disclosed in the drawings, Maxon v. Maxon Construction Co., 395 F.2d 330, 334-35, 158 USPQ 77, 79-81 (6th Cir. 1968); see Continental Paper Bag Co. v. Eastern Paper Bag Co., 210 U.S. 405, 418-19 (1908).

(l) It is not necessary per se to encumber claims with detailed recitals. This is confirmed by MPEP Section 706.03(d):

> The fact that a claim is broad does not necessarily justify a rejection on the ground that the claim is vague and indefinite or incomplete. . . . a claim may, in general, be drawn as broadly as permitted by the prior art.

(m) The case of Andrews Corp. v. Gabriel Electronics, Inc., 6 USPQ 2d 2010 (CAFC 1988) conclusively affirms a § 112 position that relative and somewhat imprecise phrases such as "approach each other," "close to," "substantially equal" and "closely approximate" satisfy § 112 both legally and factually where such phrases serve to distinguish the claimed invention and one of ordinary skill is able to understand the meaning thereof.

34. Based upon the foregoing, there is no prohibited ambiguity contained within the presently pending elected Claims. I believe that the presently pending elected Claims fully satisfy

the statutory and case law requirements of § 112, second paragraph. Accordingly, it is respectfully requested that the § 112, second paragraph rejection be reconsidered and withdrawn or, better stated, that it not be reasserted against currently pending Claims.

35 I hereby declare that all statements made herein are of my own knowledge to be true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under § 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

DATED this 7 day of March, 2000.

Rodney La Follette

RODNEY M. LAFOLLETTE, PH.D.

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